

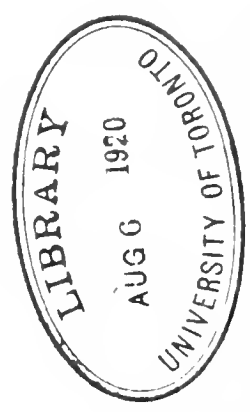
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# SOLAR PHYSICS OBSERVATORY

SEVENTH ANNUAL REPORT OF THE DIRECTOR OF THE  
SOLAR PHYSICS OBSERVATORY TO THE  
SOLAR PHYSICS COMMITTEE

1919 APRIL 1—1920 MARCH 31



**University of Cambridge**

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# Seventh Annual Report of the Director of the Solar Physics Observatory

22 May 1920.

The VICE-CHANCELLOR begs leave to publish to the Senate the following Report which the Solar Physics Committee have received from the Director of the Solar Physics Observatory:

The Report here presented relates to the year 1919 April 1 to 1920 March 31.

Mr F. J. M. Stratton resigned the office of Assistant Director at Michaelmas 1919, to undertake tutorial duties at Caius College: he continues research work on stellar spectra at the Observatory.

Mr E. A. Milne, B.A., Fellow of Trinity College, has been appointed Assistant Director, and will begin the duties of the office on 1 October 1920. Meanwhile he is undertaking some research work at the Observatory.

Mr W. E. Rolston is still absent with the Army of Occupation at Cologne.

The apparatus taken to the Crimea in July 1914 for the solar eclipse was reported to have been intact in the Custom House at Odessa on 4 February 1920. On that date after considerable delays the necessary permissions for export were granted: but two days later Odessa was evacuated by the Allies, and the instruments remain in the Custom House. No further information is yet available.

## A. Stellar Work.

The discussion of the spectrograms of Nova Geminorum II, secured in 1912 at Cambridge and at Allegheny has been completed by Mr Stratton, and the memoir summarising the results is now in the hands of the printers. It is an important piece of work which was begun before the war, and was taken up again by him on his return to the Observatory from military service in the middle of February 1919.

One of the most important points dealt with is Mr Stratton's discovery of a marked displacement of absorption lines which he has identified with features characteristic of the spectra of certain helium stars of type B. These lines which indicate the presence of nonmetallic gases such as oxygen, nitrogen and helium appear somewhat fitfully in the spectrum of the nova, and indications are present of alternations in conspicuousness with the enhanced absorption lines of the metals iron, titanium etc. The memoir sets forth the succession of phenomena observed in Nova Geminorum II, and though the data are insufficient to form a theory of the cause of the outburst of a nova, the discussion is likely to be important in relation to the interpretation of the more definite phenomena of Nova Aquilæ III (1918).

The work on Nova Aquilæ III, to which reference was made in last year's report, has been continued by Mr Baxandall. After making a preliminary study of photographic enlargements of the set of glass positives sent by Dr Plaskett, Director of the Dominion Observatory, Victoria, B.C., Mr Baxandall has now measured and reduced a considerable number of this valuable set of spectra, and is still occupied in the measurement of the plates. His work shews that the absorption lines characteristic of  $\alpha$  Cygni and of  $\gamma$  Orionis form as conspicuous features in Nova Aquilæ III as in Nova Geminorum II.

Two notes by Mr Baxandall have been published, one dealing with the identification of certain lines in the spectrum of Nova Aquilæ III (*Publ. Ast. Soc. Pac.*, Vol. 31, 297) and the other on apparent changes in the spectrum of  $\eta$  Carinæ ( $\eta$  Argûs) (*Monthly Notices R. A. S.*, 79, 619).

In a note communicated to the Royal Astronomical Society on Variations in the Ultraviolet spectrum of Nova Aquilæ III (*Monthly Notices*, 79, 498), Mr Butler called attention to changes detected by him in the earliest photographs secured by the Yerkes observers on the first three nights of the outburst of the Nova.

Some work on special features in the spectra of Nova Aquilæ III is being carried out by Mr E. S. Pearson of Trinity College.

## B. *Solar Work.*

*Spectroheliograph.* Photographs of the sun's disc in calcium  $K_{2,3,2}$  light have been obtained on 98 days (previous year, 111) and photographs of the prominences at the limb on 86 days (previous year, 101). The photographs are taken on alternate days by Mr Butler and Mr Moss.

The general activity of the sun, as evidenced by the calcium flocculi, has continued to decline, though there have been several large outbursts, notably those of January and March 1920, the latter being probably a recurrence of the earlier one.

Numerous photographs of the large prominence which formed such a conspicuous feature on the plates secured at Sobral and Principe during the total eclipse of the sun on 1919 May 29 were obtained here, and a note by Mr Moss recording the changes observed at Cambridge from hour to hour, communicated to the Royal Astronomical Society (*Monthly Notices*, 79, 553), has proved to be a valuable contribution to the discussion of the remarkable phenomenon.

The 18-inch and 6-inch mirrors were dismantled on 1920 February 12 and were replaced on February 16 after being resilvered.

The Director of the Kodaikanal Observatory has forwarded 331 spectroheliograms shewing the sun's disc in calcium  $K_{2,3,2}$  light for the year 1919 January 1—December 31. Of the 34 days missed in the Kodaikanal records, there are Cambridge records for 7 days.

Great progress has been made in dealing with the arrears in photographic enlargements of the spectroheliograms received during the war: Mr Manning has made 922 of such enlargements in the past year: and thus the work up to the end of 1918 has been overtaken. The orientation of the images, on which, since they are taken with a Foucault heliostat, the fiducial directions are a function of the time of observation, is now provided for by special appliances which have been fitted to the small heliomicrometer of De la Rue. In this manner each photograph to be examined is marked with the direction of diurnal motion and the position of the solar axis. The work is in the hands of Mr Butler.

*Study of Spectroheliograms.* The examination of the Kodaikanal spectroheliograms in search of evidence of systematic distribution of the brighter calcium flocculi on the sun's disc has been continued by Mr Butler. A special protractor has been designed and constructed to facilitate the measurement of the inclination of the groups of flocculi to the projected parallel of latitude.

*Photoheliograms.* Daily photographs taken with the Dallmeyer photoheliograph at Dehra Dûn have been received as usual, and the negatives are stored at the Science Museum, at South Kensington.

*Study of Sun Spot Records.* The examination of proper motions of spot groups in solar longitude and latitude is being continued. The required reductions relating to the cycle 1889—1901, which have been studied by the Director with the assistance of Mrs Beech, are nearly completed. Similar work relating to the cycle 1902—1913 has been begun by Mr Moss on lines indicated by the work done in relation to the preceding cycle. The Greenwich ledgers have been mounted as a card catalogue, a procedure which considerably reduces the amount of clerical work.

*Optical refraction in the neighbourhood of the Sun.* In connexion with the detection, at the recent eclipse, of the expected minute deflection of beams of starlight passing near the sun, the question of the amount of such deflection that might possibly be attributable to optical refraction by vaporous matter extending to distances very large compared with those contemplated in a purely gravitational atmosphere has been studied by the Director. Of two communications to the Royal Astronomical Society, the first dealt with general considerations on the physical aspect of the Einstein prediction (*Monthly Notices*, 80, 22), the other set forth results that might arise from action of the repulsive forces (such as radiation pressure and electric forces) which would be required to maintain a sensible distribution of gaseous matter extending to some distance around the sun and which would act according to the inverse square law. The latter communication (*Observatory*, 1920, April, p. 145) summarises in general terms the results of rather tedious evaluation by quadratures of the integral of refraction under various assumed relations between the repulsive forces and gravitation. Further consideration of the possibilities in this direction seems to be needed before it can be definitely asserted that optical refraction is entirely excluded and that the observations made at Sobral and Principe constitute a crucial verification of the Einstein prediction.

### C. *Meteorological Physics.*

*Investigations in Atmospheric Electricity.* The results of the investigations made at the observatory by Mr C. T. R. Wilson during the last five years on lightning discharges and on the electric field in thunderstorms have been discussed by him and have been set forth in a paper recently communicated to the Royal Society. An indication of some of the principal conclusions then obtained was given in last year's report.

These observations are being continued and preparations are being made for experiments and investigations relating to definite problems which have suggested themselves in the course of the work especially in connexion with the flow of electricity between the ground and shower clouds.

*Study of Ionizing Radiations by the Cloud Track Method.* During the first year of Mr Wilson's service as Observer in Meteorological Physics a number of successful stereoscopic photographs of the tracks of ionizing particles by his condensation method were obtained. The investigations which were interrupted by the war have now been resumed. The material already obtained is now being studied in detail and improved apparatus is being constructed for continuing the investigation by this powerful and beautiful method.

### D. *Miscellaneous.*

*International Meeting at Brussels, July 1919.* The Director, as one of the British delegates representing the subjects of Astronomy, Geodesy and Geophysics, attended the international meeting held at Brussels during July 1919 to consider the constitution of the International Research Council and of International Unions in those subjects.

*Lectures.* Lectures have been given by the Director in the October term 1919 on Solar Research, and by Mr Stratton on Series in Spectra and on Stellar Physics.

*Appointment of a University Reader in Electrical Meteorology.* Mr C. T. R. Wilson has been appointed University Reader in Electrical Meteorology, for a term of five years from 1 October 1919.

*Library.* A number of valuable publications and reprints have been received in the course of the year, and the Director desires to record his grateful acknowledgments to the donors. A list of such donations is appended.

H. F. NEWALL.

SOLAR PHYSICS OBSERVATORY,  
10 May 1920.

The Director gratefully acknowledges the receipt of the following works, which have been presented to the Library of the Solar Physics Observatory:

ASTRONOMY.	DONORS.
American Astronomical Society. Publications. Vol. III. Northfield, Minn. 1918. 8vo.	The Society.
Astrophysical Journal. Vol. XLIX. No. 2—Vol. L. No. 5. Chicago, 1919. 8vo.	Prof. Newall.
Brussels. Annuaire de l'Observatoire royal de Belgique. 1916–20. Brussels. 8vo.	The Observatory.
Brussels. Annales de l'Observatoire Royal de Belgique. Tome XIV, fasc. II. Brussels, 1918. 4to.	„
Cape of Good Hope. Royal Observatory. Independent Day-Numbers. 1920–21. London, 1919. 8vo.	„
Cape of Good Hope. Royal Observatory. Report of H.M. Astronomer. 1917–18. London, 1919. Fsep.	„
Copenhagen. Observatorium. Publikationer og mindre Meddelelser. Nos. 30–34. København, 1919.	„
Copenhagen. Universitets Astronomiske Observatorium. Ephemeriden-Zirkular der Astronomische Nachrichten. (Temporary publication of the Kiel Centralstelle ephemerides, etc.) Nos. 563–571. Kiel, 1919. 4to.	„
Edinburgh. Royal Observatory. Annual Report, No. 29. Edinburgh, 1919.	„

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- Greenwich, Royal Observatory. Clock Star List, 1920. London, 1919. 4to. The Observatory.
- Greenwich, Royal Observatory. Annual Report of Astronomer Royal, 1919-19. London, 1919. 4to. „
- Harvard College Observatory. Annals. Vol. LXXVIII. Part 3; Vol. LXXXI. Part 1; Vol. LXXXII. Parts 1, 2; Vol. LXXXIII. Part 3; Vol. LXXXV. Part 1; Vol. XCII.; Vol. XCIII. Cambridge, Mass., 1918-19. 4to. „
- Harvard College Observatory. Bulletins. Nos. 667-684. Cambridge, Mass., 1918-19. 4to. „
- Harvard College Observatory. Circulars. Nos. 209-220. Cambridge, Mass., 1918-19. 4to. „
- Harvard College Observatory. Report. No. 73. Cambridge, Mass., 1918. 8vo. „
- Johannesburg, Union Observatory. Circulars. Nos. 44-46. Johannesburg, 1919. 4to. „
- Lick Observatory. Bulletins. Nos. 321-327. Berkeley, Cal., 1919. 4to. „
- London, Royal Astronomical Society. Monthly Notices. Vol. LXXIX. No. 4-Vol. LXXX. No. 3. London, 1919-20. 8vo. The Society.
- Madrid, Observatorio. Anuario, 1920. Madrid, 1920. 8vo. The Observatory.
- Ottawa, Dominion Observatory. Publications. Vol. III. Parts 9-12; Vol. IV. Parts 1-20. Ottawa, 1916-19. 4to. „
- Paris, Observatoire. Rapport Annuel, 1916-7-8. Paris, 1917-19. 4to. „
- Rio de Janeiro. Observatorio Nacional. Anuario, 1919-20. Rio de Janeiro, 1918-19. 8vo. „
- San Fernando. Instituto y Observatorio de Marina. Almanaque Nautico y Suplemento, 1917-8-9. San Fernando, 1916-7-8. 8vo. „
- Sidmouth, The Hill Observatory. Bulletin. Vol. I. No. 6. Sidmouth, 1919. 4to. „
- Tortosa. Observatorio del Ebro, Roquetas, Spain. Boletín Mensual. Vol. IX. No. 5-Vol. X. No. 6. Tortosa, 1916-18. 4to. „
- Tortosa. Observatorio del Ebro, Roquetas, Spain. Memorias, No. 6. Tortosa, 1919. 4to. „
- Washington, United States Naval Observatory. American Ephemeris, 1921. Washington, 1920. 8vo. „
- Washington, United States Naval Observatory. Annual Report, 1919. Washington, 1919. 8vo. „
- Wellington, New Zealand Hector Observatory. Bulletin. Nos. 12-21. Wellington, 1918. 8vo. „
- Zürich, Sternwarte des eidg. Polytechnikums. Astronomische Mitteilungen. No. 108. Zürich, 1919. 8vo. „

## METEOROLOGY.

- Argentina. Oficina Meteorologica. Boletín Mensual, 1917 Aug.-1918 Mar. Buenos Aires, 1919-20. 4to. The Office.
- Australia. Commonwealth Bureau of Meteorology. Bulletin. No. 15. Melbourne, 1919. 4to. The Bureau.
- Australia. Commonwealth Bureau of Meteorology. Maps. Rainfall, 1918. Melbourne, 1919. „
- Australia. Commonwealth Bureau of Meteorology. Memoir. No. I. Melbourne, 1918. 4to. „
- Australia. Commonwealth Bureau of Meteorology. Monthly Weather Report. Vol. IV. Nos. 8-9. Melbourne, 1918. 4to. „
- Australia. Commonwealth Bureau of Meteorology. Results of Rainfall Observations in South Australia and Northern Territory up to 1917. Melbourne, 1918. 4to. „
- Brera. R. Osservatorio astronomico di Brera in Milano. Osservazioni Meteorologiche e Geofisiche, 1918. Milano, 1919. 4to. The Observatory.
- Canada. Dominion Meteorological Service. Monthly Weather Review, 1916 Supplement. 1918 Nov.-1919 Sep. Toronto, 1918-19. 4to. Department of Marine and Fisheries.



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- Christiania. Norwegisches Meteorologisches Institut. Jahrbuch. 1918. The Institute.  
Kristiania, 1919. Fol.
- Christiania. Norwegisches Meteorologisches Institut. Oversigt over  
luftens temperatur og nedbøren i Norge. 1917. Kristiania, 1919.  
8vo. „
- Christiania. Norske Meteorologiske Institut. Nedbøriagttagelser i Norge.  
1918. Kristiania, 1919. Fol. „
- Edinburgh. Scottish Meteorological Society Journal. Vol. xviii. No. The Society.  
xxxvi. 1918. Edinburgh, 1919. 8vo.
- Holland. Institut météorologique royal. Caractère Magnétique de chaque  
jour des mois. 1918 Trim. 3—1919 Trim. 3. de Bilt, 1919–20. Fol. The Institute.
- London, Meteorological Office. Daily Weather Reports. 1919, April The Committee.  
—1920, March. London. 4to.
- London, Meteorological Office. Weekly Weather Reports. 1917, Mar. „  
31—1919, Mar. 22. London, 1916–17. 4to.
- London, Meteorological Office. Monthly Weather Reports. 1919, March—  
1920, Jan. London, 1919–20. 4to. „
- London, Meteorological Office. Daily Readings at Meteorological Stations  
of the first and second orders. 1919. London, 1919–20. 4to. „
- London, Meteorological Office. Geophysical Journal. 1918, Nos. 4—12. „  
London, 1919–20. 4to.
- London, Meteorological Office. Southport Auxiliary Observatory. Annual  
Report. 1918. London, 1919. 8vo. „
- London, Meteorological Office. The Book of Normals of Meteorological  
Elements for the British Isles for periods ending 1915. London,  
1919. 8vo. The Office.
- Mauritius, Royal Alfred Observatory. Annual Reports. 1918. Mauritius, The Observatory.  
1919. Fscp.
- Mauritius, Royal Alfred Observatory. Results of the Magnetical and  
Meteorological Observations. Nov. 1918—Aug. 1919. Mauritius,  
1918–19. 4to. „
- Montecassino, Osservatorio Meteorico-Aerologico-Geodinamico. Bolletino  
Mensile. 1917 Nov.—Dec.—1919 Mar. Cassino, 1919. 4to. „
- New Zealand. Government Meteorological Observatory. Meteorological  
Tables from the New Zealand Gazette. Dec. 1918—Nov. 1919. „  
Wellington, 1919–20. Fscp.
- Oxford, Radcliffe Observatory. Results of Meteorological Observations.  
1918. Oxford, 1919. 8vo. „
- San Fernando. Instituto y Observatorio de Marina. Anales, Seccion 2. The Institute.  
1914–17. San Fernando, 1919. Fol.





